

REMARKS

Claims 18-37 are pending in this application. Claims 18-20 and 22-27 are amended, claim 21 remains unchanged and claims 28-37 are added. No new matter is being added.

The Office Action objected to claim 18 based on a lack of antecedent basis for the term “the core”. Claim 18 is amended to obviate the objection. As a result, Applicants request that the objection be withdrawn. This is the only amendment made to claim 18 and as a result Applicants submit that if the current prior art rejection is overcome, the next Office Action, if any, should not be final.

The Claimed Invention

An exemplary embodiment of the invention, as recited by independent claim 18, is directed to an electric machine including a brushless DC motor having a rotor and permanent magnets that are rectangular and protrude into material recesses in the rotor. The material recesses extend axially inside the rotor and laterally in the circumferential direction of the rotor in such a manner that the permanent magnet protrudes into the material recesses at least with its axial edges adjacent to the peripheral surface of the rotor so that the permanent magnet is wider in the circumferential direction than its appurtenant pole shoe neck of the rotor and abuts against the pole shoe of the rotor with a partial width of its external surface and that the partial width corresponds to a tooth shoe width of a stator tooth in the circumferential direction.

Another exemplary embodiment of the invention, as recited by new independent claim 28, is directed to an electric machine including a brushless DC motor having a rotor which is provided with a plurality of rectangular permanent magnets that protrude into material recesses in the rotor. The material recesses extend axially inside the rotor and laterally in the circumferential direction of the rotor in such a manner that the permanent magnet protrudes into the material recesses at least with its axial edges adjacent to the

peripheral surface of the rotor so that the permanent magnet is wider in the circumferential direction than an appurtenant pole shoe neck of the rotor and abuts against a pole shoe of the rotor with a partial width of its outer surface, and the partial width of the external surface of the permanent magnet is approximately equal to a tooth shoe width of one of the stator teeth in the circumferential direction.

Another exemplary embodiment of the invention, as recited by new independent claim 29, is directed to an electric machine including a brushless DC motor having a rotor and a plurality of rectangular permanent magnets embedded in magnet retention areas. Each magnet retention area having two material recesses located circumferentially adjacent to each magnet retention area such that axial edges of the magnet protrude into the material recesses.

In order that permanent magnets of an electric motor do not detach from the rotor at high speeds, they can be embedded in the rotor and completely encircled by the rotor iron in the radial direction. In this way, a closed magnetic circuit is produced between the poles of the permanent magnet via the rotor iron whereby the magnetic flux between the rotor and stator is reduced and thus the efficiency of the electric machine is reduced.

It is an object of the present invention to provide a cost-effective electric machine with a high efficiency which is designed for a high speed range.

The invention addresses and solves this problem by providing magnet retention areas that hold rectangular magnets, material recesses into which edges of the magnets protrude, and rotor pole shoes and stator tooth shoes of particular shapes.

The Sakai Reference and the Iles-Klumpner Reference

The Office Action rejected claims 18-27 under 35 U.S.C. 103(a) as being unpatentable over JP 2003-88071 A (Sakai) in view of U.S. Patent No. 7,230,359 (Iles-Klumpner). Applicants respectfully traverse the rejection.

Claim 18 includes the feature of the permanent magnets being rectangular. The Office Action admits that Sakai does not show this feature, but applies Iles-Klumpner as

showing rectangular magnets and asserts that it would have been obvious to use the rectangular magnets of Iles-Klumpner in the device of Sakai. Applicants respectfully disagree with this assertion.

Figure 3 of Sakai shows part of the magnetic flux (hollow arrows) being directed back out of rotor 6 in an arcuate manner that follows the curvature of the outer most part of magnet 7. Applicants submit that it would not have been obvious to replace the curved magnets of Sakai with the rectangular magnets of Iles-Klumpner because there would have been no reason to believe that rectangular magnets would redirect the magnetic flux in this same manner.

Also, according to a machine translation generated by the Japanese Patent Office website, paragraph 0035 of Sakai states that the shape of magnet 7 can ease the concentration of stress on certain parts of magnet 7 that results from centrifugal force during rotation. Applicants submit that it would not have been obvious to replace the curved magnets of Sakai with the rectangular magnets of Iles-Klumpner because rectangular magnets would distribute the centrifugal force differently than the curved magnets of Sakai and Sakai specifically states that the curved shape is beneficial in easing stress concentrations.

Claim 18 includes the feature of the end surface of the stator tooth shoe adjacent to the rotor being flat and tangential to the circumferential surface of the rotor. In contrast, the ends of stator teeth 4 of Sakai are not flat and, as a result, are not tangential to the circumferential surface of rotor 5. Figure 1 of Sakai shows the stator 1 (mostly in broken lines) as having a curved inner surface made up of the ends of teeth 4. The ends of teeth 4 follow the curve shown in a broken line. There is no indication that the ends of stator teeth 4 are anything but curved to follow the broken line.

The specification at paragraph 015 states that the invention's flat shape of the end surfaces of the stator teeth and their tangential relation to the rotor has the advantage that during operation a torque having a particularly low ripple can be produced. This results in low noise emissions even at high rotor speeds and improved efficiency.

Claim 18 includes the feature of the permanent magnet being wider in the circumferential direction than its appurtenant pole shoe neck of the rotor and abuts against the pole shoe of the rotor with a partial width of its external surface. In contrast, the outer most surface of magnet 7 of Sakai is not wider in the circumferential direction than the office action defined pole shoe neck 6b. First, Applicants submit that the office action defined pole shoe neck 6b of Sakai is not a neck at all. As shown in Figure 2 of the application, pole shoe 14 is necked down to a flat surface that is narrower in width in the circumferential direction. Sakai does not show any necking down of the rotor to form the claimed neck. Further, Figure 2 of Sakai clearly shows that the surface of the rotor that the office action asserts corresponds to the claimed pole shoe neck is wider in the circumferential direction than magnet 7. Figure 2 of Sakai also shows that magnet 7 does not abut against area 6b with a partial width of the external surface of magnet 7. The *entire* external surface of magnet 7 (the uppermost surface of magnet 7 in Figure 2) abuts surface 6b.

The arguments presented above also apply to new claim 28.

In view of the foregoing, Applicants respectfully submit that the combination of Sakai and Iles-Klumpner does not teach or suggest the features of claims 18-27 and therefore rejection under 35 USC §103(a) is inappropriate. As a result, Applicants respectfully request withdrawal of the rejection.

New Claims

New claims 28-37 are directed to an electric machine having features, including some which are similar to those of claim 18, that are not disclosed or suggested by the applied references.

CONCLUSION

In view of the above, Applicants respectfully request entry of the present Amendment and allowance of claims 18-37. If the Examiner has any questions regarding this amendment, the Examiner is requested to contact the undersigned. If an extension of time for this paper is required, petition for extension is herewith made.

Respectfully submitted,

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